Course Code: 1BMACV201 **Course: Applied Mathematics-II for Civil Engineering**
Credits: 4 **L:T:P:S 3:2:0**
SEE: 50% Marks **CIE: 50% Marks**
SEE Hours: 3 Hrs **Max. Marks: 100**

Prerequisites if any	Tracing of curves
Learning objectives	The goal of the course **Integral Calculus, Vector Calculus and Numerical methods (1BMACV201)** is to 1. **Familiarize** the importance of Integral calculus and Vector calculus essential for civil engineering. 2. **Develop** the knowledge of numerical methods to solve civil engineering problems.

Course Outcomes:
On the successful completion of the course, the student will be able to

	Course Outcomes	Bloom's level
CO1	Apply the concept of multiple integral to solve proper & improper integrals.	Understand, Apply, Analyse
CO2	Operate vector differential operator 'del' on vector and scalar point functions and compute vector line integral.	
CO3	Apply the knowledge of numerical methods in solving physical and engineering problems	
CO4	Develop familiarity with modern mathematical tools namely SCILAB/PYTHON/MATLAB and stimulates creative problem solving through experiential learning.	

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	-	-	-	-	-	-	1		3	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	1		3	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	1		3	-	-	-
CO4	3	-	-	-	3	-	-	-	-	-	-		-	-	-	-

Strong: 3 **Medium: 2** **Low: 1**

Course Content

	Module – 1 Integral Calculus	No. of Lecture Hours	No. of Tutorial Hours	Self-Learning Hours
1.1	Reduction formulae for the integrals of $\sin^n x$, Reduction formulae for the integrals of $\sin^n x$, $\cos^m x$,$\cos^n x \sin^m x \cos^n x$.	2	1	
1.2	Multiple Integrals: Evaluation of double and triple integrals.	3		
1.3	Evaluation of double integrals by change of order of integration.	1	1	
1.4	Evaluation of double integrals by changing into polar coordinates.	1	1	
1.5	Applications to find Area and Volume by double integral.	1		
	Module – 2 Vector Calculus-I			
2.1	Vector Differentiation: Scalar and vector fields, gradient of a scalar field.	2	1	
2.2	Directional derivatives.	1		
2.3	Divergence of a vector field, solenoidal vector.	2	1	
2.4	Curl of a vector field, irrotational vector.	1		
2.5	Physical interpretation of gradient, divergence and curl and scalar potential.	2		
	Module-3 Vector Calculus-II			
3.1	Vector Integration: Line integrals, work done by a force and flux, Surface and volume integrals.	2	1	
3.2	Green's theorem (without proof).	2		
3.3	Stoke's theorem (without proof).	2	1	
3.4	Gauss divergence theorem, problems (without proof).	2	1	
	Module –4 Numerical Methods- I			
4.1	Solution of algebraic and transcendental equations.	1	1	
4.2	Solution of algebraic and transcendental equations: Newton-Raphson methods, problems.	2		
4.3	Interpolation: Finite differences, Interpolation using Newton's forward and backward difference formulae.	2	1	
4.4	Newton's divided difference formula.	1		
4.5	Numerical integration: Trapezoidal, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.	2		
	Module –5 Numerical Methods -II			
5.1	Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method.	2	1	
5.2	Modified Euler's method.	2		
5.3	Runge-Kutta method of fourth order.	2	1	
5.4	Rayleigh's power method to find dominant eigenvalue and eigenvector.	2		
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours		12	
	Total No. of Self learning Hours			

Textbooks:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

1. **B. V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017.
2. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **Tom Apostol** "Calculus: Multi-Variable Calculus and Linear Algebra with applications to differential equations and Probability, Vol.2, Wiley publications, 2nd edition, 2007.
4. Thomas's Calculus, Maurice D Weir, Joel Hass, Pearson, 13th edition, 2008.
5. Advanced engineering mathematics, Jain and Iyyengar, Narosa publications, 5th edition, 2002.

Online Resources:

1. https://www.youtube.com/watch?v=ixDGaEqWuA0
2. https://www.youtube.com/results?search_query=nptel+linear+algebra